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AGRICULTURAL MEMORANDUM NO 1015

AN IMPROVED 'SAUCER' SCREEN FOR WET AND DRY THERMISTORS

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Introduction:

For some time now, thermistors have been used in conjunction with the Didcot Automatic Weather Station to measure temperature by the agro-meteorological department at Cambridge. The method used for shielding the sensors from direct solar radiation has been to place them in the centre of a vertical stack of inverted flower pot saucers. This is a simple and practical solution to the problem, and has provided many accurate datasets in the past. However, it became apparent at the end of the Cereal Crop Monitor experiment in August 1983 that the original saucer screens had become so dilapidated as to be of no further use. Therefore, in order to conduct the next trials in cereals, a new set of screens was needed, and so a new, improved version was designed and built. The need was amplified by the impending arrival of the 'Squirrel' meter-logger with its associated thermistors.

The New 'Saucer' System

The principle objections to the old screens were the materials used, and the fact that the thermistors were horizontal. Corrosion of the nuts and bolts used was the main problem, making inspection and maintenance very difficult. This can easily be circumvented by using brass rod, nylon nuts, and zinc-plated nuts. As a further aid tc construction and wear in the field, some white plastic flower pot saucers were used. This obviated the need to paint them white, with the consequent problems of the paint then peeling off after long exposure in the sun.

A temperature sensor such as a thermistor enclosed in a long, cylindrical metal sheath should ideally be exposed to a horizontal airflow in a vertical orientation. Theoretically, this should make its response omnidirectional, whereas a horizontal configuration introduces the possibility of the response to axial flow being different to transverse flow. Another advantage of having the sensors mounted vertically is that they are then closer to the 'core' of the screen, and therefore better shielded than if they are laid horizontally with their extremities close to the edge of the screen. Of course, if two thermistors are used as a wet and dry pair, then care must be taken to ensure that their separation is adequate.

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Deciding to place the thermistors vertically in the screen poses no great problems in itself, but having one acting as a 'wet-bulb' does create extra complications. The main problem is that the wick and water-level have to be inspected, and renewed when required; - often in uncomfortable conditions with cold fingers. The solution employed was to mount the thermistors in a 'gallows' type of arrangement, with the water reservoir directly beneath the 'wet' thermistor as illustrated in the cross-section of Figure 1. Having the water directly beneath the thermistor is the only sensible arrangement really, as the wick should ideally have no kinks in it. The sensors are held in a strip of plastic card 2 cm wide, and are gripped in place by suitably sized rubber grommets. The plastic card is supported by two small lengths of brass rod mounted on saucer no 5, and it can be removed by unscrewing two wing nuts. Space for the thermistors and their mounts is created by cutting out parts of saucers 3 and 4, as illustrated in Figure 2.

The water reservoir is a round, polythene food container, intended for deep freeze storage. This is screwed to saucer no 6 through its lid. A more elegant solution to the problem would have been to use a suitably sized transparent container, so that the water level could be observed at a glance, but none could be found. Access to the water reservoir is provided by a short piece of polythene tube, (8 mm internal diameter,) and made easier by having part of a plastic funnel serve as a 'mouth'.

The saucers are held together by vertical lengths of 2 B A brass rods running through the edges of them. Plastic tubing cut to lengths of 3 cm is slipped over the rod, in between the saucers, to act as spacers. Three rods run through the whole screen, but only the lowest three saucers are securely fastened to them. The top three are held together as a separate body by three more, shorter brass rods, and this acts as a 'lid', using the protruding longer set of rods as guides on which to slide on and off. The top half of the screen is screwed in place by three wing nuts on the uppermost saucer, and these facilitate swift removal in the field for inspection purposes.

As yet it has not been possible to compare this design of screen with a standard screen, so no definitive claim can be made about its accuracy. However, as the basic concept has been used successfully in the field for some years now, there does not appear to be any reason why this version should not give similarly sensible readings.

Any comments or suggestions should be sent to the author.

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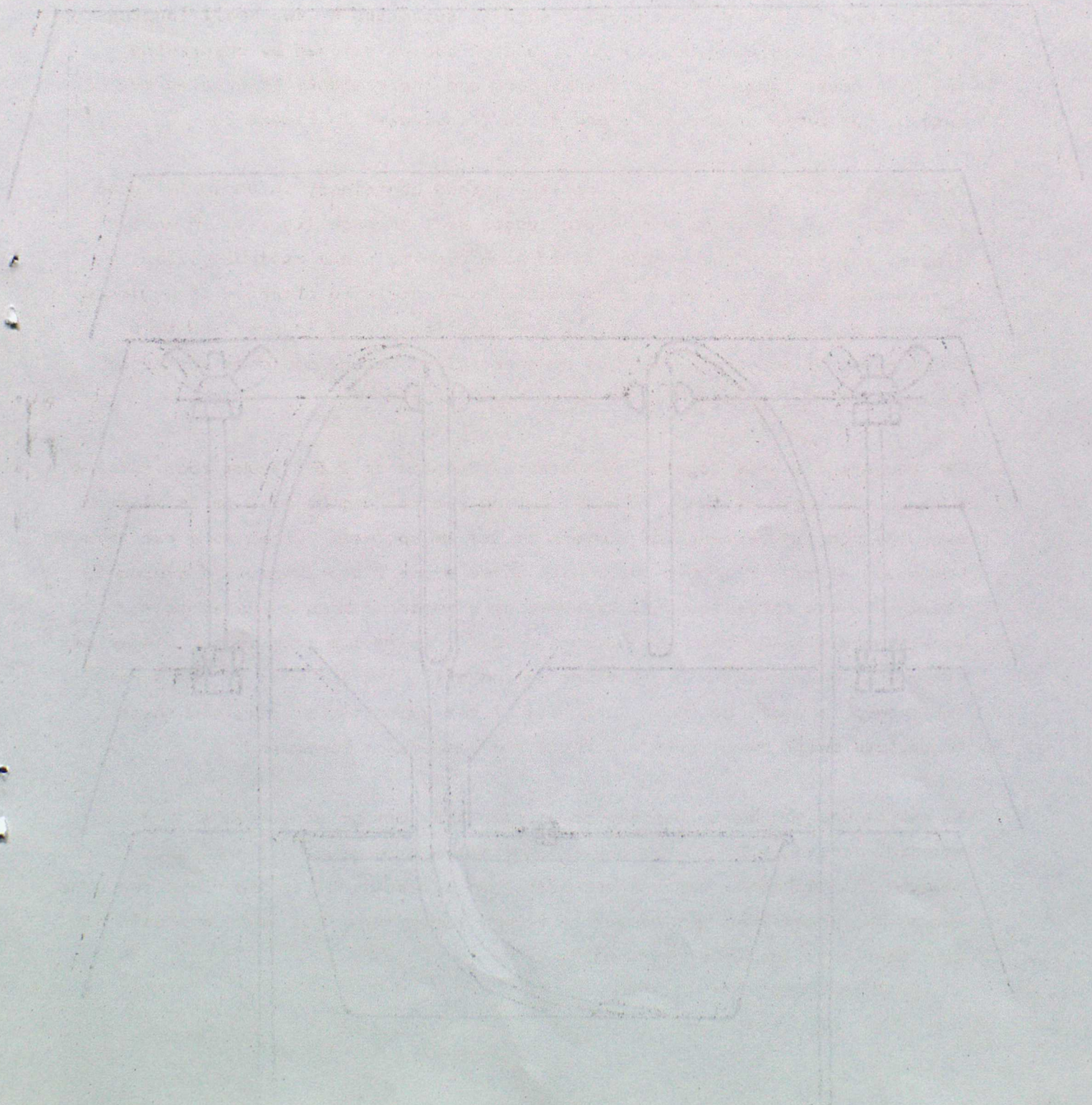


Figure 1. Cross-section of the screen, showing 'gallows' arrangement for the thermistors.

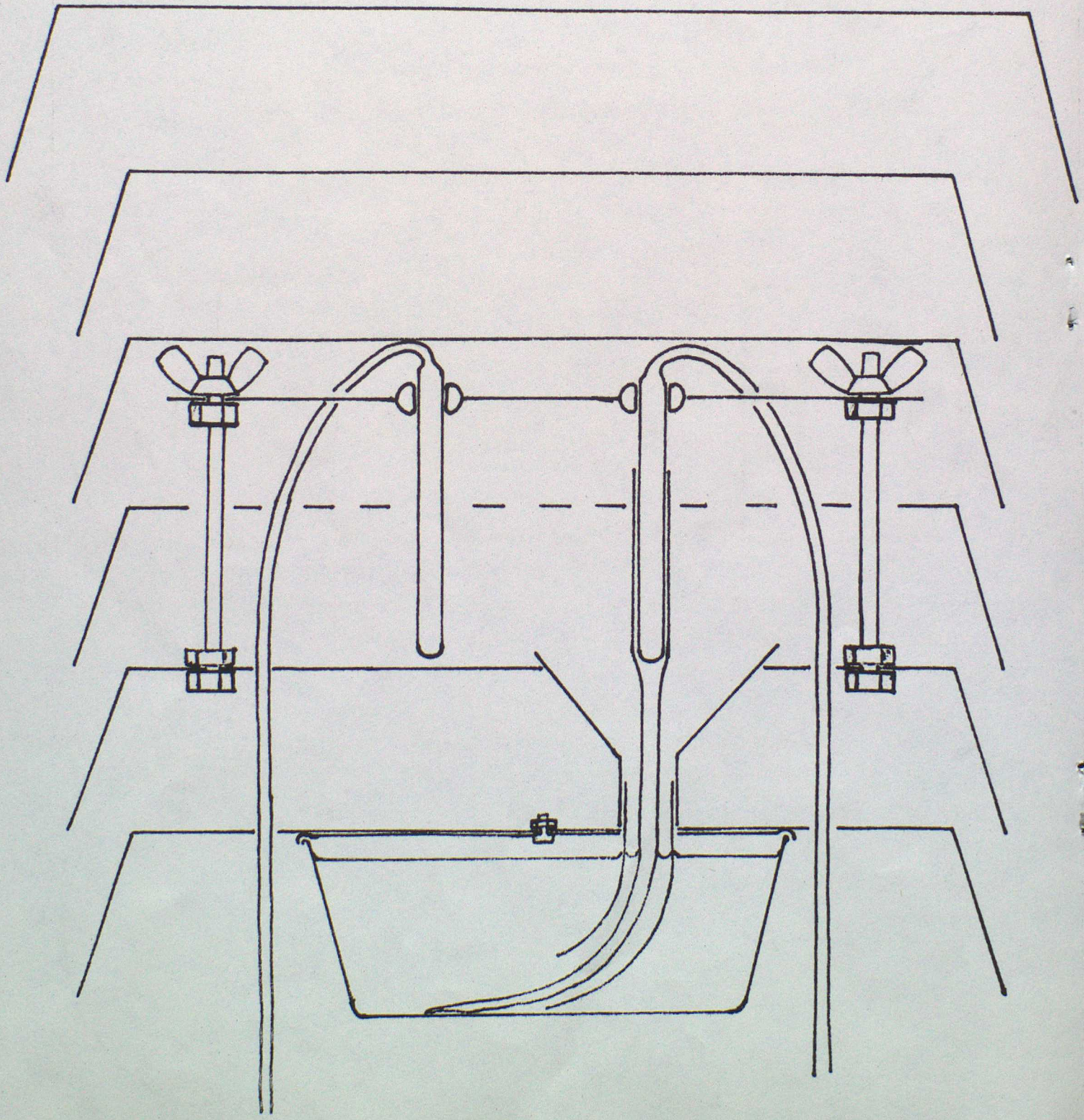
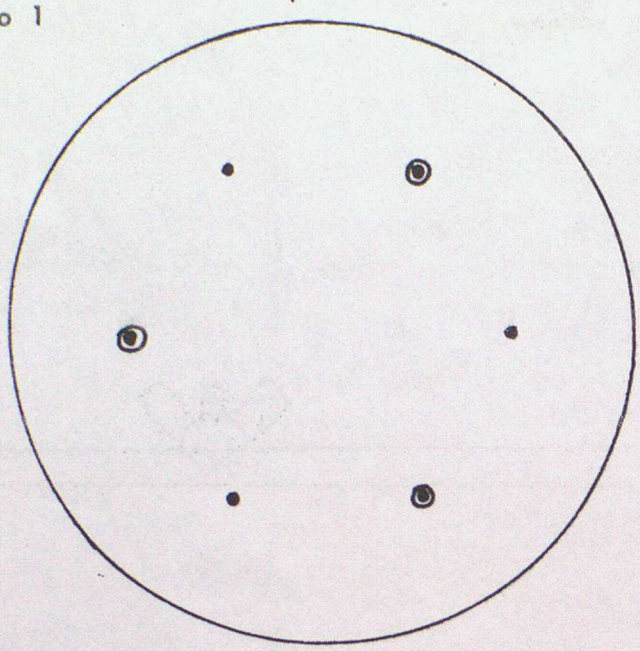


Figure 2. Position of holes and 'cut-outs' in all the saucers

No 1



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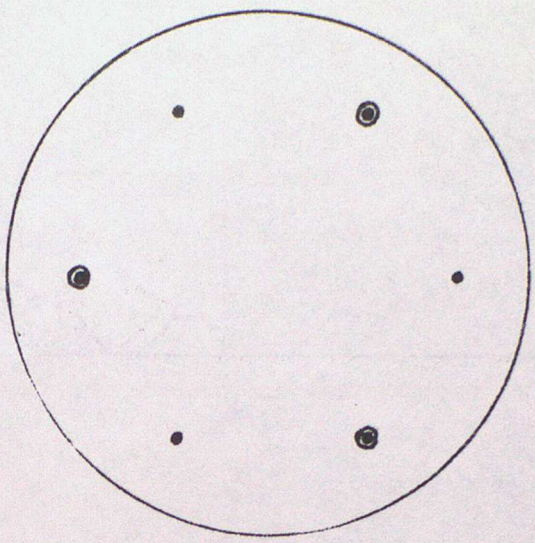

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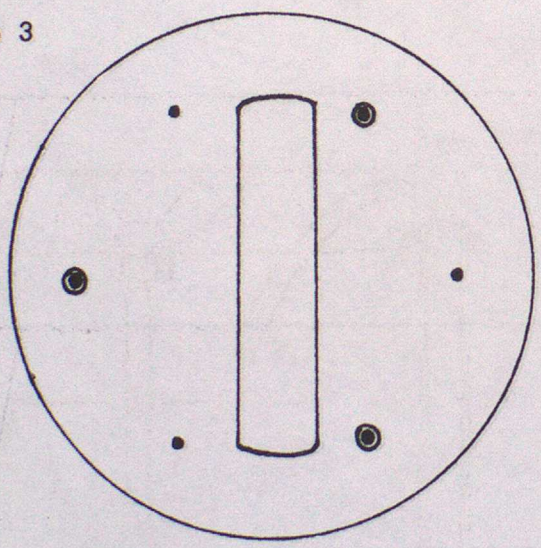

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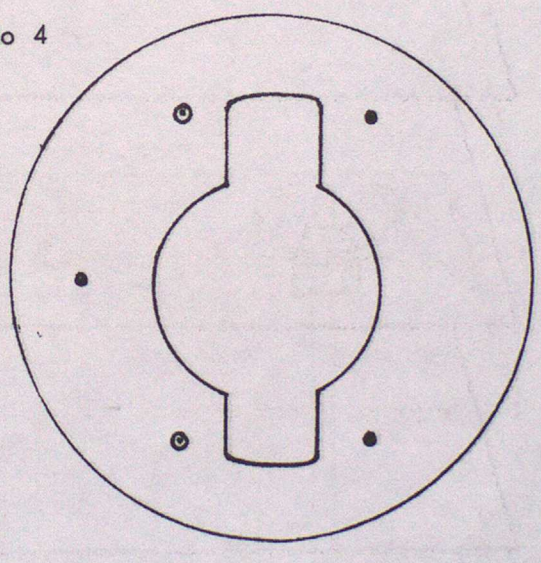

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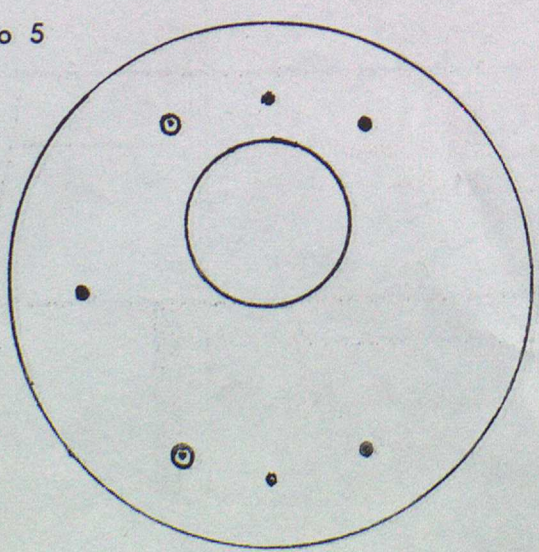

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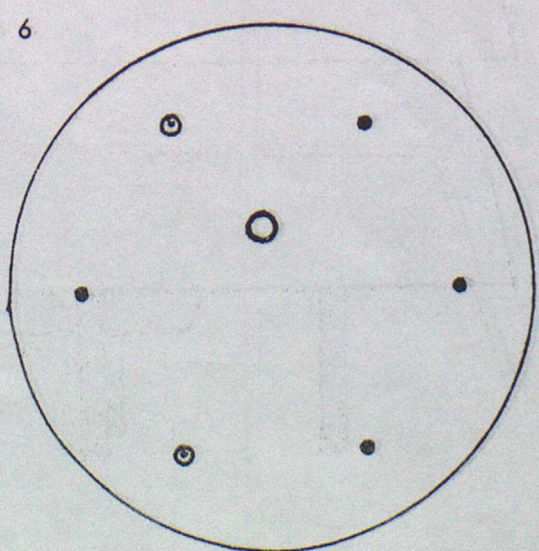

Figure 3. External appearance of the screen.